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## (54) Area communication systems

(57) An area communication system for providing positional information about a plurality of individually identifiable elements includes identification tags 4 attachable to moveable elements, the identification tags being interrogated by interrogator units 3 locatable at one or more access points to zones forming the area and the results of the interrogation being transmitted to a central monitoring unit 1. The central monitoring unit includes a status register 1a for monitoring which identification tags are in operation, a location register 1b for monitoring the zonal position of the identification tags, a paging encoder 1c for encoding a paging signal prior to transmission by a paging transmitter 5 and a telephone interface 1d connectable to a PABX 6. A display 1f may provide continuous position and status information or provide such information on demand. The manner in which paging signals are transmitted is dependent on the zonal position information maintained by the location register 1b.

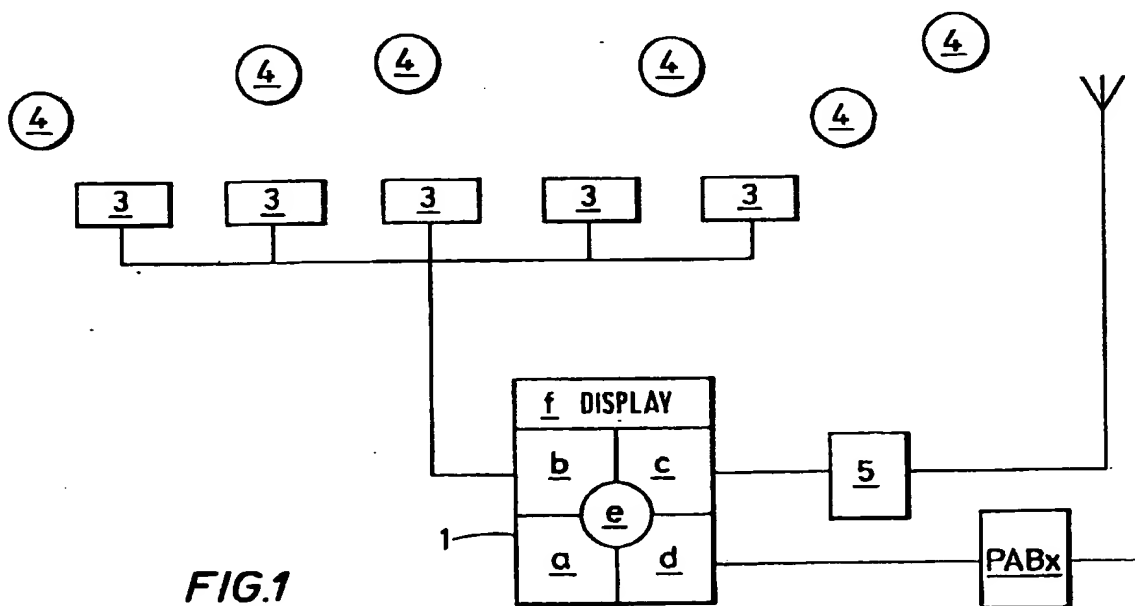


FIG.1

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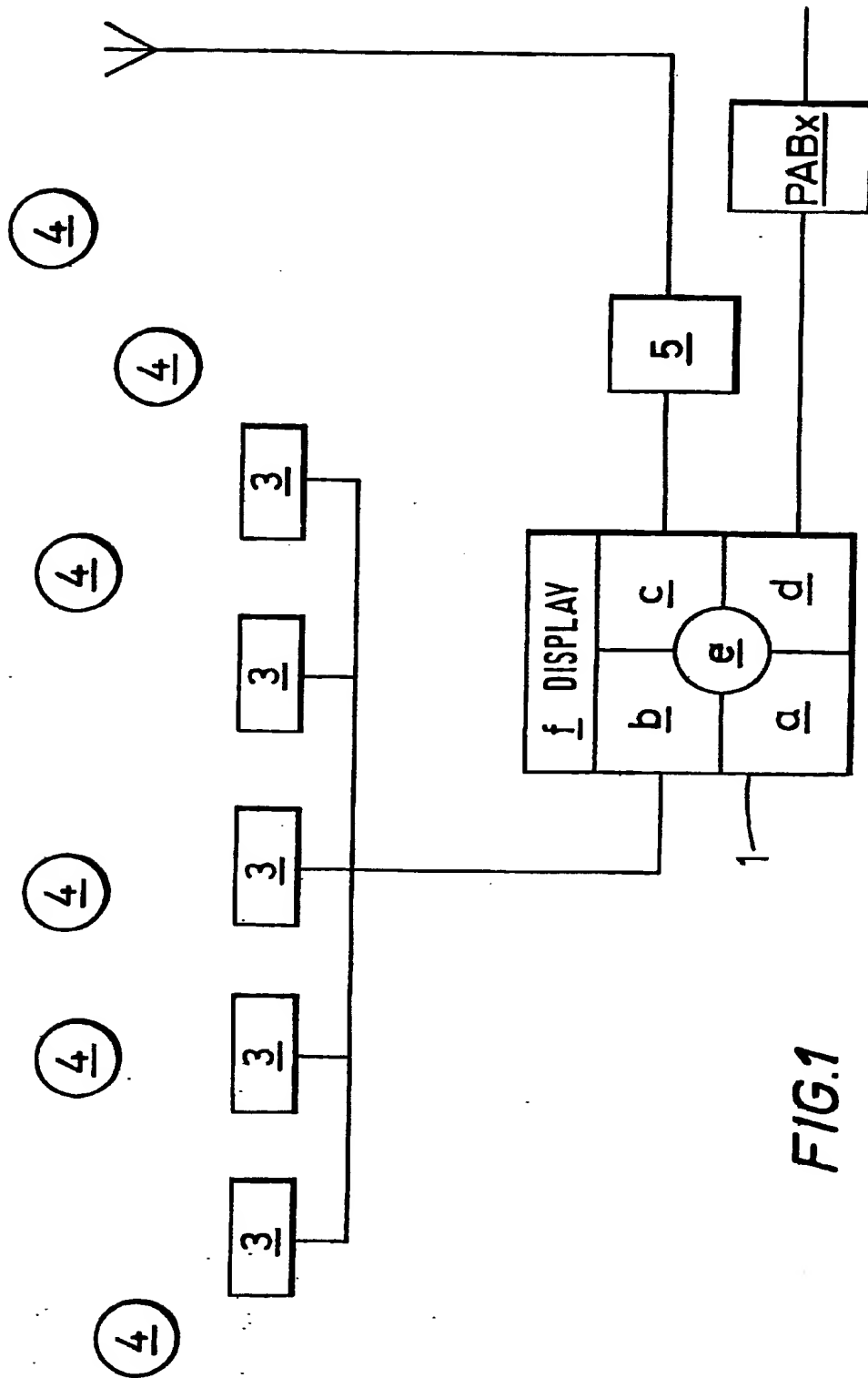
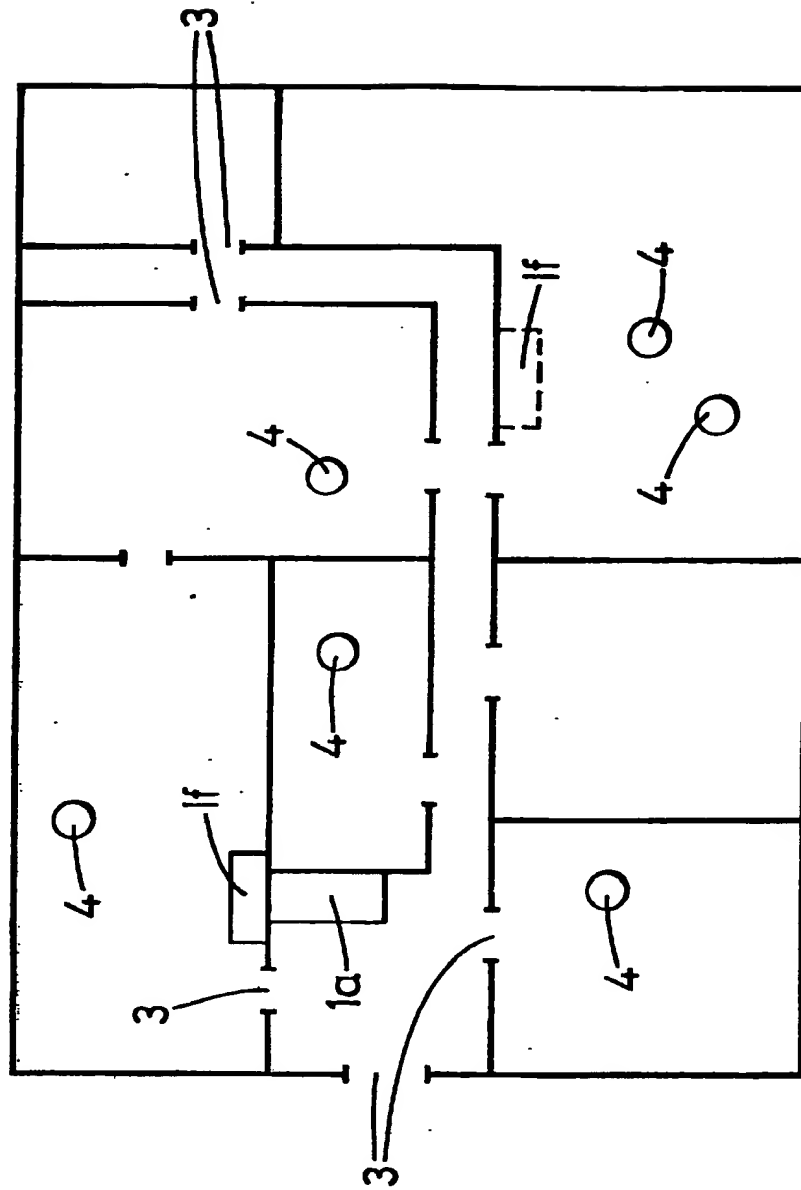


FIG. 1



## SPECIFICATION

### Area communications systems

- 6 This invention relates to area communications systems.

Known area communications systems use short-range radio communications to communicate between a central unit and one or more remotely distributed moveable elements. In these communications systems each moveable element may be provided with a communication device having a unique address to enable it to respond to transmissions from the central unit. In simple versions, the communication device may just respond to a call signal and then provide some form of attention-getting signal to the user; more sophisticated systems may permit two-way communications between the central unit and moveable element. Additionally, such moveable elements may be provided with an additional address which is common to several moveable elements thereby forming a predetermined group. In this way a group, team or family of moveable elements may be contacted simultaneously.

Door entry systems, in which someone seeking access offers a card carrying a bar code or magnetic stripe to a reading head, are also known. These have been developed into automatic identification systems. In an alternative system an interrogator unit emits a signal via an aerial located close to a doorway or access point and will only permit access in response to an acceptable coded signal received from a low power transmitter-receiver "radio tag" carried by the person approaching.

According to one aspect of the present invention there is provided an area communication system for providing positional information about one or more moveable elements within an area, the system comprising:

- 45 an identification tag locatable on or associated with each moveable element; and
- at least one interrogator unit operable to interrogate the identification tags, each interrogator unit being locatable at an access point to one or more zones within the area, the interrogator units being linked to a central monitoring unit for monitoring the movement of identification tags past the interrogator units to provide continuous position monitoring of the zonal positions of the moveable elements provided with identification tags.

Advantageously, the efficiency, flexibility of operation, and reliability of communications systems can be much improved if the location of the moveable elements is known.

According to another aspect of the present invention there is provided an area communication system comprising:

- 65 a plurality of identification tags associated with a respective plurality of moveable ele-

ments;

- 70 interrogator units operable to interrogate the identification tags, each of the interrogator units being located at an access point to a respective zone;

a central monitoring unit responsive to the interrogator units for monitoring the movement of the identification tags past the interrogator units to provide information as to the zonal location of each of the moveable elements; and communication apparatus for providing a communication link to and/or from the zones, the operation of the communication apparatus being controlled by the central monitoring unit in accordance with the location information relating to the moveable elements.

The central monitoring unit preferably includes a status register, the status register registering which of the identification tags are in operation and which are not.

Advantageously, the combination of a paging receiver and a radio tag in a single portable unit provides more information at the control point of the paging terminal in respect of the status of personnel, than would be available from a paging receiver alone.

Advantageously, the efficiency and usefulness of emergency communications systems can be improved by using the positional information provided by continuous monitoring of the moveable elements. In hospitals, for example, key members of staff carry paging receivers and can be alerted by means of a radio transmission, to the occurrence of, say, a cardiac arrest. If one or more people failed to respond to such a "group alert" call, the results could be disastrous. This might occur for a number of reasons: if they were already dealing with another emergency; if they did not hear the bleeps (in an area of high ambient noise); if they were not within range of the transmitter; or if their paging receiver or some other part of the paging system had developed a fault. If the locations of the members of staff were known, both before and after transmission of the paging call, this could enable their response to be monitored.

Paging systems will sometimes include a limited number of portable units which have a talkback transmitter in addition to the receiver; this would enable a moveable element say, to report to a control room at intervals throughout its movement around an area. An example of this would be a night-watchman patrolling an industrial complex. If the portable unit again incorporated a radio tag, then the location of the element at all times could be displayed on a console in the control room. In the event of breakdown or any form of accident causing immobilisation, which prevented the element from calling in after a pre-set period of time, or from reaching the next interrogation point after the normal period (plus a margin) taken to complete that particular leg of a tour, then an alarm would sound at the console and as-

distance could be directed to the location shown. The time taken to cover each individual leg of the tour can be programmed into the paging terminal during the setting up procedure. Separate radio circuits are required in the portable unit for the paging and location functions, but the unique digital code identity, normally given to a paging receiver or radio tag operating in a stand-alone role, can now be shared by both.

Alarm systems are becoming increasingly popular, particularly in sheltered accommodation. Individuals carry a low power transmitter which can be activated by pressing a "panic" button; although the coded signal will identify who is sending the call, it will not indicate their location within the building. If the alarm transmitter incorporates a radio tag and the outputs from the interrogation points, spread throughout the building, are fed to a central processor and are coupled to a display unit situated in the entry hall, then immediately on entry to the building, a warden could ascertain where his assistance is required.

In order that the invention may be more fully understood it will now be further described by way of illustrative and non-limiting example, with reference to the accompanying drawings, in which:

Figure 1 shows a general arrangement of an area communication system; and

Figure 2 shows a diagram of how the area is to be sub-divided into zones.

Figure 1 shows an integrated area communications and location system. A central monitor unit 1 is shown as being sub-divided into a number of sub-units, including a status register 1a which records the status of each of the moveable elements. This information is stored against the name and/or identity number of each person and includes the unique address of their identification tag and may be used to indicate if they are on or off duty, whether or not they are members of a larger team (for example, an emergency team), locations in which they should not be paged, and possibly a message-taking facility such as a telephone number. The central monitoring unit 1 also incorporates a location register 1b, for monitoring the locations of the individuals carrying identity tags. The central monitoring unit 1 also includes a paging encoder 1c for producing the appropriate paging code prior to transmission by a paging transmitter 3. The central monitoring unit 1 also incorporates a telephone interface 1d, a central processor 1e, and a display unit 1f.

In operation, as the moveable elements carrying identification tags 4 move around the area covered by the communication system, they will in moving from zone to zone pass an interrogator unit 3. The interrogator units 3 are located at access points to zones comprising the area, the boundaries being chosen to subdivide the area into zones of convenient

size. When each moveable element passes the interrogator unit 3, the interrogator unit interrogates the identification tag 4 which in turn responds with its own identity. The identity of the moveable element is then transmitted to the location register 1b which records a change of zone and monitors the presence of the moveable element 4 in the area. The interrogator units 3 are so arranged and located to permit the m to determine the transition from one zone to another of the moveable elements 4. The location of a particular moveable element may be displayed on the display unit 1f either continuously or on demand. In the event that the moveable element is a person carrying a radio pager and identification tag, the person can be coupled into the paging terminal by using the telephone interface 1d and a PABX 6. For those individuals who have a one to one relationship with particular telephone extensions, when there is no reply from that extension the terminal may intercept the call and check the status and location registers. If the party being called is on duty and can be traced to a given zone then the call may be transferred to a telephone within that zone. Alternatively a paging call could be initiated and the extension number of the caller displayed on the paging receiver.

Additionally, the location register 1b may be accessed from any telephone extension by inputting an entry number followed by the identity number of the individual being traced. Presence in a particular zone could cause the central processor to send a voice prompt, indicating which zone this is, back to the caller.

Figure 2 shows a general arrangement of a area sub-divided into a plurality of zones. Upon entering or exiting the area, each of the moveable elements or identity tags 4 should have its status recorded at the status register 1a. In order to gain access to any of the zones, the identity tag 4 must pass an interrogator unit 3 which will interrogate the tag, and having determined its identity, pass the information to the central monitoring unit 1. In moving from one zone to another the identification tag 4 must pass an interrogator unit 3, when the interrogation process is repeated and the new location of the tag will be transmitted to the location register 1b which will then be updated. In this way, the location of the various identifiable moveable elements can be monitored continuously, and the location register can provide continuous positional information via the display 1f. The display may be located either centrally along with the central monitoring unit 1, (not shown), or there may be provided a plurality of display units 1f in the zones.

A preferred embodiment of the invention can be used in, for example, a hospital. In this particular application, the whole hospital area is sub-divided into zones, each zone comprising, for example, a ward, an operating theatre

or the office of a member of staff. Upon entering the hospital, the member of staff records his arrival and on-duty status at the status register 1a. His progress through the hospital to his place of work can then be monitored as he passes the various interrogator units 3. If the member of staff were part of an emergency team and an emergency were to arise, he can be paged via the radio paging system, the paging tone being such as to indicate an emergency has arisen. Having determined the location of the emergency, his progress towards the site of the emergency can be monitored as he passes the interrogator units 3. In the event that any member of the team were not to respond to the emergency call by moving towards the zone in which the emergency has occurred, then further measures can be brought quickly into action, either for example, a re-issuing of the paging call or the use of some other attention-getting means.

In one mode of operation, when the operator initiates a "group alert" call on the paging system, the pagers carried by the members of that group or team will emit a train of short 'pips' in quick succession, for example for about 4 seconds. The operator will also key in a short numeric or alphanumeric code which indicates the area where the emergency has occurred; this will be displayed on the pagers (the operator may reinforce the displayed information by means of a spoken message). The terminal will be holding, in memory store, a record of the locations of all staff equipped with the portable unit, at the moment when the group alert is initiated. Any team member who is recorded as being effectively "unavailable", will immediately be flagged up on the operator's console, or any member who has not entered the emergency zone within, say, 30 seconds of call initiation, will also be shown. This warns the operator that secondary action is necessary.

Such a system can also conveniently be used to provide not just the zonal positioning information but also to provide security facilities and restrict access to secure zones to those with an authorized right of entry.

In the cases where a paging receiver or alarm transmitter is provided, a radio identification tag may be incorporated in the receiver or transmitter. In such a situation, a unique digital code identity can be shared by both the radio tag and the receiver or transmitter.

If this type of area communication system were used in a factory or similar industrial environment for monitoring the progress of work around the factory, each job could be given a unique identification number and its progress from one zone to another, which may represent its progress from one department to another, could be monitored by use of interrogator units 3, to provide the location register 1b with a record of work in progress

and an indication of its status. Clearly, in such a case connections with a PABX 6 would not be necessary.

In an alternative application in which the system is used to monitor the positions of key medical staff whose rapid response is vital in an emergency, an operator will key in the location of the assembly point and press the group call button. Data is transferred under the control of the central processor 1a from the status and location registers into the encoder 1c and formatted into a signal which then modulates the paging transmitter 5. The identity of any team member who cannot, or does not, respond to the call, by moving into the zone which includes the assembly point, will be displayed on the control unit; further measures must be brought quickly into play in the event of such an occurrence.

In a useful additional feature the operator can determine the location of members of staff, without initiating a paging call, simply by entering the appropriate command into a local control unit, which may be connected to the central monitor unit 1 and include the display 1f.

#### CLAIMS

1. An area communication system for providing positional information about one or more moveable elements within an area, the system comprising:
  - an identification tag locatable on or associated with each moveable element; and
  - at least one interrogator unit operable to interrogate the identification tags, each interrogator unit being locatable at an access point to one or more zones within the area, the interrogator units being linked to a central monitoring unit for monitoring the movement of identification tags past the interrogator units to provide continuous position monitoring of the zonal positions of the moveable elements provided with identification tags.
2. An area communication system according to claim 1 in which the central monitoring unit includes a status register, the status register registering which of the identification tags are in operation and which are not.
3. An area communication system according to claim 1 or claim 2 in which the identification tags are each linked to individually addressable pagers.
4. An area communication system according to claim 3 in which the pagers are radio pagers.
5. An area communication system according to any one of claims 1 to 4 in which the identification tag includes a magnetic code and the interrogator unit is operable to determine the magnetic code.
6. An area communication system according to any one of claims 1 to 4 in which the identification tag incorporates a low power transmitter and receiver and is interrogated by

a radio means.

7. An area communication system according to any one of the preceding claims in which the central monitoring unit is provided with a

5 display means for displaying the status of the identification tags and their zonal positions.

8. An area communication system comprising:

10 a plurality of identification tags associated with a respective plurality of moveable elements;

interrogator units operable to interrogate the identification tags, each of the interrogator units being located at an access point to a respective zone;

15 a central monitoring unit responsive to the interrogator units for monitoring the movement of the identification tags past the interrogator units to provide information as to the zonal location of each of the moveable elements;

20 and

communication apparatus for providing a communication link to and/or from the zones, the operation of the communication apparatus being controlled by the central monitoring unit in accordance with the location information relating to the moveable elements.

25 9. An area communication system substantially as hereinbefore described with reference to the accompanying drawings.

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